

IN THE CLAIMS:

1. A method for manufacturing a semiconductor device that has a substrate with an interlayer insulation film thereon, the interlayer insulation film having therein a contact hole, a via hole, or a trench for a plug electrode or buried wiring, wherein the contact hole, via hole, or trench is lined with a tantalum oxide film, a tantalum-base barrier film, an amorphous metal film, and a copper-based conductive film and is filled with the copper-based conductive film to form a plug electrode or buried wiring, the method comprising the steps of:

preparing a semiconductor substrate, formed in which is the interlayer insulation film provided with the contact hole, via hole, or trench;

forming the tantalum-base barrier film in the contact hole, via hole or trench;

forming the copper-based conductive film on the tantalum-base barrier film; and

heat-treating the semiconductor substrate with the tantalum-base barrier film and the copper-base conductive film in a non-oxidizing atmosphere,

the tantalum oxide film being formed between the interlayer insulation film and the tantalum-base barrier film at an interface surface therebetween, and at a same time the amorphous metal film comprising tantalum and copper being formed between the tantalum-base barrier film and the copper-based conductive film at an interface surface therebetween.

2. A manufacturing method of the semiconductor device, according to claim 1, wherein:

in the step of heat-treating said semiconductor device, said semiconductor device is a heat-treated at a heat-treatment temperature of from 400 to 700°C for a heat-treatment period of from 2 to 20 minutes.

3. The method according to claim 1, wherein the copper-based conductive film is formed by using a first step of forming a copper-based thin film on the tantalum-base barrier film, and a second step of forming a copper-based thick film on the copper-based thin film.